

Taxon: <i>Elaeagnus angustifolia</i>	Family: Elaeagnaceae
Common Name(s): oleaster Russian olive	Synonym(s): <i>Elaeagnus angustifolia</i> var. <i>orientalis</i> <i>Elaeagnus hortensis</i> M. Bieb. <i>Elaeagnus moorcroftii</i> Wall. ex <i>Elaeagnus orientalis</i> L.

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 5 Mar 2015
WRA Score: 13.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Environmental Weed, Thorny Tree, N-Fixing, Thicket-Forming, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic	y=1, n=0	n
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems		

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	y
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence of domestication] "E. angustifolia is a tall shrub (up to 15 m and 1 m d.b.h.), with a dense, rounded crown, native to Europe and Asia and an important deciduous species of arid and semi-arid areas of northwestern China. It was introduced into the USA in the early 1900s, and has now become extensively naturalized in riparian areas of western states bordered on the east by North and South Dakota, Nebraska, Kansas, Oklahoma and Texas (Olson and Knopf, 1986a, 1986b; Shafroth et al., 1995). It also occurs in southern Canada from Ontario to British Columbia. It grows in some eastern USA states, but is not naturalized (Tesky, 1992)."
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Low
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Russian-olive is native to temperate areas of Eurasia, and is adapted to the general climatic conditions that characterize much of interior western North America. "

Qsn #	Question	Answer
202	Quality of climate match data	Intermediate
	Source(s)	Notes
	Daehler, C. 2002. WRA Screening Criteria. Unpublished guidelines. University of Hawaii, Honolulu	"For the special case of a temperate species whose seeds have been reported to require cold-stratification for germination, the answer to this question is 0 (low) and the answer to question 2.02 is 1 (intermediate) regardless of knowledge of the species' native range."
	Katz, G. L., & Shafroth, P. B. (2003). Biology, ecology and management of <i>Elaeagnus angustifolia</i> L. (Russian olive) in western North America. <i>Wetlands</i> , 23(4): 763-777	"To break dormancy, <i>E. angustifolia</i> seeds require a period of after-ripening (Hogue and LaCroix 1970, Hamilton and Carpenter 1976, Belcher and Karrfalt 1979). In general, under laboratory conditions, cleaned seeds germinate best after pre-chilling for approximately 90 days under moist conditions at 5 °C (Hogue and LaCroix 1970, Belcher and Karrfalt 1979)."

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Elevation range exceeds 1000 m, & demonstrates environmental versatility in temperate climates] " <i>E. angustifolia</i> is found in a range of environments as it is tolerant of drought and saline, alkaline or infertile soils (Vines, 1960; Olson and Knopf, 1986a, 1986b), and has a well-developed root system." "Climatic amplitude (estimates) - Altitude range: 0 - 2400 m - Mean annual rainfall: 100 - 470 mm - Rainfall regime: summer - Dry season duration: 5 - 9 months - Mean annual temperature: 5 - 9°C - Mean maximum temperature of hottest month: 17 - 27°C - Mean minimum temperature of coldest month: -25 - -6°C"

204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Russian-olive is native to temperate areas of Eurasia, and is adapted to the general climatic conditions that characterize much of interior western North America. "

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes

Qsn #	Question	Answer
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed]	"It is unclear when Russian-olive was initially introduced to North America, although its introduction as a horticultural plant was certainly intentional. Russian-olive has been cultivated for shade, hedges, wind- and snowbreaks, soil stabilization, wildlife habitat, landscaping, and to provide pollen for honeybees both in its native range and in North America [16,94,96,198]. It was introduced to many of the Great Plains and southwestern states by the early 1900s, and remained a cultivated landscape plant for many decades [41,177]. It was used extensively in windbreaks throughout the Great Plains in the 1930s and 1940s in association with government programs. As recently as the 1980s and 1990s, some state and federal agencies continued to subsidize distribution of Russian-olive seedlings in the U.S. and Canada [96,137]."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It was introduced into the USA in the early 1900s, and has now become extensively naturalized in riparian areas of western states bordered on the east by North and South Dakota, Nebraska, Kansas, Oklahoma and Texas (Olson and Knopf, 1986a, 1986b; Shafroth et al., 1995). It also occurs in southern Canada from Ontario to British Columbia. It grows in some eastern USA states, but is not naturalized (Tesky, 1992)."

301	Naturalized beyond native range	Y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It was introduced into the USA in the early 1900s, and has now become extensively naturalized in riparian areas of western states bordered on the east by North and South Dakota, Nebraska, Kansas, Oklahoma and Texas (Olson and Knopf, 1986a, 1986b; Shafroth et al., 1995). It also occurs in southern Canada from Ontario to British Columbia. It grows in some eastern USA states, but is not naturalized (Tesky, 1992)."
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Russian-olive now occurs throughout most of the U.S. including all western states but excluding most southeastern states. Plants database provides a state distribution map of Russian-olive. It is most problematic in the Southwest, Intermountain West, and Great Plains regions of the U.S. [52]. Olson and Knopf [138] give detailed Russian-olive distribution information for 17 western states as of 1986. While it is present in much of the central and northeastern U.S., it is generally described as only occasionally or rarely escaping cultivation ([96] and references therein). In Canada, Russian-olive occurs in all of the southern mainland provinces except Saskatchewan and Newfoundland [93]. It is reported to be spreading from cultivation in British Columbia, Alberta, Manitoba, and southern Ontario. Russian-olive was not considered a species of concern in Canada in 1996 (based on a national survey) [78]. There are no documented occurrences of Russian-olive in Mexico; however, suitable sites may exist in parts of the Sierra Madre of Chihuahua and Sonora ([96] and references therein). Russian-olive has also spread from cultivation in semiarid parts of South America [102]."

302	Garden/amenity/disturbance weed	
-----	---------------------------------	--

Qsn #	Question	Answer
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[Able to colonize & exploit disturbed sites] "In some cases Russian-olive invades areas where disturbance results in microsites with favorable conditions, such as road and railroad ditches, and irrigated and/or heavily grazed pastures (e.g. [47,148]). Along the Milk River in Montana and Alberta, the highest densities of Russian-olive were along the reach that had more livestock grazing and beaver harvesting, as both beaver and livestock prefer cottonwood over Russian-olive [140]. Similar observations were made by Lesica and Miles along other Montana rivers [112,113]. Russian-olive is also invasive on sites at later successional stages, due to its shade tolerance and ability to establish in intact ground cover [95,156]."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>E. angustifolia</i> has a tendency to spread to areas where it is not desired, necessitating careful monitoring of sites planted with this species as once established, it is difficult to control and nearly impossible to eradicate. It can interfere with agricultural practices, displace native riparian vegetation and choke irrigation ditches (Olson and Knopf, 1986a). For this reason, it has been declared a noxious weed in Utah, USA, and has had to be controlled in Illinois, Colorado, Nebraska and South Dakota (Tesky, 1992)."
	Bovey, R. W. (1965). Control of Russian olive by aerial applications of herbicides. <i>Journal of Range Management Archives</i> 18(4): 194 195	"Russian olive trees (<i>Elaeagnus angustifolia</i> L.) have become a pasture weed problem in the North Platte River Valley of Nebraska. Russian olive grows rapidly and spreads by seeds and underground rootstalks, crowding out desirable forage species"

304	Environmental weed	y
	Source(s)	Notes
	Weber, E. 2003. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	"The species quickly spreads and forms dense thickets that crowd out native vegetation and prevent the establishment of native trees. It replaces native riparian forests in North America and causes loss of wildlife habitat."

305	Congeneric weed	y
	Source(s)	Notes
	Weber, E. 2003. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	" <i>Elaeagnus umbellata</i> " ... "This fast growing shrub spreads rapidly in mesic to wet habitats and disturbed areas. It forms dense thickets displacing native vegetation and preventing the regrowth and regeneration of native plants. Fruit production is prolific and seeds are dispersed by birds."

401	Produces spines, thorns or burrs	y
	Source(s)	Notes

Qsn #	Question	Answer
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 4 Mar 2015]	"Russian-olive is a perennial, tree or large multi-stemmed shrub. It has dark, smooth and sometimes shredding bark. Its branches are flexible and often armed with coarse thorns."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"This fast-growing (up to 1.8 m per year), nitrogen-fixing species has silver-grey leaves with entire margins (4.5-9 cm), olive-shaped fruit and long thorns."

402	Allelopathic	n
	Source(s)	Notes
	Pisula, N. L., & Meiners, S. J. (2010). Relative allelopathic potential of invasive plant species in a young disturbed woodland 1. <i>The Journal of the Torrey Botanical Society</i> , 137(1): 81-87	[No evidence] "We conducted laboratory bioassays for 10 co-occurring non-native species to determine the relative strength of their allelopathic potential. These species represented a suite of successful invaders within a young forest and were from a variety of plant life forms: trees, lianas, shrubs, and herbs. We determined the germination responses of a target species to a gradient of leaf extract concentrations to assess relative allelopathic potential." ... "Extracts of the fourth shrub species, <i>E. angustifolia</i> , had no significant effect on target seed germination." ... "Our laboratory bioassays confirmed the presence of some allelopathic capability for all but one of the invasive specie's extract tested (<i>Elaeagnus angustifolia</i>)."

403	Parasitic	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence] " <i>E. angustifolia</i> is a tall shrub (up to 15 m and 1 m d.b.h.), with a dense, rounded crown, native to Europe and Asia and an important deciduous species of arid and semi-arid areas of northwestern China."

Qsn #	Question	Answer
404	Unpalatable to grazing animals	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The fruits and leaves are valuable for food and animal fodder, whilst the tree is considered a good source for bee foraging."
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[Age and browser dependent. Palatable when young. Unpalatable when mature] "Domestic livestock browse young Russian olive trees [16], (Katz personal observation as cited by [96]), but adult Russian-olives deter browsers with sharp thorns and defense compounds in the leaves (Seastedt personal communication as cited by [96]). Rabbits may eat the bark of small trees. Poultry (chickens, turkeys, ducks, pigeons) may eat the leaves from newly planted trees [16]." ... "Palatability/nutritional value: Hansen and others [81] rank palatability of Russian-olive as poor for cattle, domestic sheep, and horses; with moderate energy and protein values. They rank food value or degree of use as fair for elk, white-tailed deer, and pronghorn; poor for mule deer; and good for upland game birds, waterfowl, small nongame birds, and small mammals [81]."
405	Toxic to animals	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "The fruits and leaves are valuable for food and animal fodder, whilst the tree is considered a good source for bee foraging."
406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Gilman, E.F. & Watson, D.G. 1993. <i>Elaeagnus angustifolia</i> . Russian-Olive. Fact Sheet ST-233. IFAS, University of Florida, Gainesville FL	"Few insects bother elaeagnus. The most likely insect problem may be an infestation by one of the scale insects. Use horticultural oil for some control." ... "Several fungi cause leaf spots on Russian-Olive but are not serious enough to warrant chemical control. Several canker diseases attack the branches and trunk, particularly in the humid east. The leaves on infected branches turn brown and persist on the tree. Usually, only the branch tip is affected. <i>Elaeagnus</i> is often killed by verticillium wilt in the east in wet areas or poorly drained sites. The disease causes wilting and browning of leaves on affected branches. Fertilize infected trees and prune out dead branches. The disease is usually fatal and has affected many plantings in the mid-west."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Pests recorded Insects: <i>Apocheima cinerarium</i> <i>Ceroplastes floridensis</i> (soft scale) <i>Thyridopteryx ephemeraeformis</i> (evergreen bagworm) Fungus diseases: <i>Lasiodiplodia theobromae</i> (diplodia pod rot of cocoa) <i>Septoria argyrea</i> Bacterial diseases: <i>Rhizobium rhizogenes</i> (gall)"

Qsn #	Question	Answer
407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The leaves, shoots, flowers, fruits and bark have been traditionally used in Chinese medicine."
	Quattrocchi, U.. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[No evidence of toxicity. Used medicinally] "Flowers for dysentery. Root extract for joint pain, febrifuge, astringent, for cough, cardiac pain. Seeds useful in cough; oil from the seeds in pulmonary affections. Flowers astringent, for dysentery."
	Sastre, J., Lluch-Bernal, M., Bustillo, A. M. G., Carnes, J., Maranon, F., Casanovas, M., & Fernández-Caldas, E. (2004). Allergenicity and cross-reactivity of Russian olive pollen (<i>Elaeagnus angustifolia</i>). <i>Allergy</i> , 59(11): 1181-1186	[Pollen may cause allergies in susceptible individuals] "In this study, we describe the allergenicity of <i>E. angustifolia</i> , a tree which is used in Madrid for ornamental and wind-cutting purposes." ... "In summary, this study confirms the presence of <i>E. angustifolia</i> pollen in the atmosphere of Madrid and the sensitizing capacity of this pollen. We have also confirmed that the inhalation of <i>E. angustifolia</i> allergens may induce nasal symptoms in sensitized patients."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[Unknown] "In some cases, dense growth of Russian-olive may be more fire-prone than native communities that it invades, although this has not been studied or reported in the literature (Also see Growth habit/stand structure)." ... "Increases in fire size or frequency have been reported in riparian areas along some southwestern [27,173,174,181] and California [23] rivers in recent decades [188]. These increases are attributed to a number of factors including an increase in ignition sources [23,174,181], increased fire frequency in surrounding uplands (e.g., [22]), increased abundance of fuels [29,60,61,135], and changes in fuel characteristics brought about by invasion of nonnative plant species (also see tamarisk in FEIS)." ... "There is no experimental evidence regarding the flammability of Russian-olive vegetation or the effects of fire on Russian-olive plants or seeds. Observational evidence indicates that Russian-olive is top killed by prescribed fire in tallgrass prairie [201] and by wildfire in riparian communities on the Rio Grande River [35]. Fire in tallgrass prairie sites generally does not top-kill trees greater than 2-inch (5cm) DBH [148,201]"

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It is relatively shade-tolerant once established and can withstand competition from other shrubs and trees, and can become a dominant climax species, replacing native cottonwoods and willows along water courses in the USA."

Qsn #	Question	Answer
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Shade tolerance: Russian-olive grows in either full sunlight or shade, but seems to prefer full sunlight (Cote and others 1988, as cited by [20]). It can establish and persist both in the shade of a mature overstory, in partial shade in margins and gaps, and in the open under full sunlight (see above). Shade tolerance may vary with latitude, although these limits are unclear. It has been suggested that Russian-olive does not thrive in shade in the northern Great Plains [72] or produce fruit in shade in "the north" [16]. Shade tolerance at northern latitudes may be related to age of Russian-olive and to moisture availability. "

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Russian-olive's success on riparian sites may be due to its ability to tolerate a broad range of soil alkalinity, salinity, and moisture availability, and to its relative lack of specialization with respect to fluvial processes compared to native riparian species [96]. " ... "Soils: Russian-olive thrives on a wide range of soil types and textures. Soils supporting Russian-olive are commonly Mollisols or Entisols, with textures ranging from clay loam to sand, with varying amounts of coarse fragments (e.g. [79,128])."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs or small trees, 3–7(–10) m tall. Bark reddish brown; spines absent or sharp, 0.7–3 cm; young branches and both leaf surfaces silvery white, densely stellate-scaly, or adaxially grayish green or green and nearly without scales (var. <i>virescens</i>)."

Qsn #	Question	Answer
412	Forms dense thickets	y
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed]	"In many sites Russian-olive grows in dense thickets with close spacing [16,47,59,81,140,168], sometimes with scattered mature cottonwood in the canopy [128]. On some southwestern riparian sites, dense, nearly monotypic stands of tamarisk and/or Russian-olive form a nearly continuous, closed canopy with no distinct overstory layer. Canopy height generally averages 16 to 33 feet (5-10 m), with canopy density uniformly high. The lower 6.5 feet (2 m) of vegetation often contains a tangle of dense, often dead, branches. Live foliage density may be relatively low from 0 to 6.5 feet (2 m) above ground, but increases higher in the canopy ([188] and references therein). Russian-olive may also grow as scattered individuals or groups under a canopy of mature riparian vegetation (e.g., [47,100,128,168]) or in mixed stands of varying canopy height and density (e.g., [100,128])."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The species quickly spreads and forms dense thickets that crowd out native vegetation and prevent the establishment of native trees."

501	Aquatic	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Terrestrial tree] "Shrubs or small trees, 3-7(-10) m tall." ... "Sea coasts, river and lake shores, dry river beds, mountains."

502	Grass	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs or small trees, 3-7(-10) m tall." [Elaeagnaceae]

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	y
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 4 Mar 2015]	"Depending on location and site conditions, Russian-olive roots sometimes associate with nitrogen-fixing bacteria (<i>Frankia</i> spp.) [117,149,179,206]. Cross-inoculation assays of <i>Frankia</i> isolates indicate that <i>Frankia</i> strains that infect Russian-olive may also infect plant species in the Rhamnaceae and Betulaceae families [17,40]. Because Russian-olive has been a common nursery plant, the scientific literature is rich with information on <i>Frankia</i> symbiosis and nitrogen fixation in Russian-olive, but this topic is beyond the scope of this review."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"This fast-growing (up to 1.8 m per year), nitrogen-fixing species has silver-grey leaves with entire margins (4.5-9 cm), olive-shaped fruit and long thorns."

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Roots: There are few descriptions of Russian-olive's root system in the literature. It is generally described as extensive [172] or deep, with many well-developed laterals. In deep soil with a calcareous clayey subsoil and water table below 15 feet (5 m), a 25-year-old, 26-foot-tall (8 m) Russian-olive had roots as long as 39 feet (12 m). A measure of root distribution by depth indicated that 23.4% of roots were in the 1st foot of soil, 26.5% in the 2nd foot, 31.6% in the 3rd foot, 18.3% in the 4th foot, and roots were rare below 4 feet (1.2 m) [203]."
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs or small trees, 3–7(–10) m tall."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "E. <i>angustifolia</i> is a tall shrub (up to 15 m and 1 m d.b.h.), with a dense, rounded crown, native to Europe and Asia and an important deciduous species of arid and semi-arid areas of northwestern China. It was introduced into the USA in the early 1900s, and has now become extensively naturalized in riparian areas of western states bordered on the east by North and South Dakota, Nebraska, Kansas, Oklahoma and Texas (Olson and Knopf, 1986a, 1986b; Shafroth et al., 1995). It also occurs in southern Canada from Ontario to British Columbia. It grows in some eastern USA states, but is not naturalized (Tesky, 1992)."

602	Produces viable seed	y
-----	-----------------------------	----------

Qsn #	Question	Answer
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"E. angustifolia is mainly established from seed, although cuttings are used in areas with sufficient moisture."

603	Hybridizes naturally	
	Source(s)	Notes
	Azimov, I. A. (1980). Selection and breeding of <i>Elaeagnus</i> . Lesnoe Khozyaistvo, 6: 66-67	[Artificial hybridization possible] "An account is given of the hybridization of large-fruited forms of <i>E. orientalis</i> and <i>E. angustifolia</i> in the 'Dendrological Park' of the Soviet Central Asian Research Institute for Forestry. Reciprocal crosses were made, a total of 1900 flowers being pollinated. The % of hybrid fruits obtained was 50.1% for the <i>E. orientalis</i> (female) X <i>E. angustifolia</i> cross, and 34.2% for the reciprocal cross. The av. wt. of the fruits was 1.5 g and 0.9 g for the respective crosses. The growth of the hybrid seedlings is described. Fruiting started 5 yr after planting out, i.e. at age 7 yr."

604	Self-compatible or apomictic	n
	Source(s)	Notes
	Pan, C., Zhao, H., Zhao, X., Liu, J., Liu, L., Hou, Y., & Zhang, L. (2011). Pollination ecology and breeding system of <i>Elaeagnus angustifolia</i> . Pp. 4507 - 4509 In Proceedings of the 2011 International Conference on Multimedia Technology. July 26-28, 2011, Hangzhou, China	"The pollination ecology and breeding system of <i>Elaeagnus angustifolia</i> were studied in introduced populations in the middle of Hexi Corridor region in Gansu province of northwest China. We applied five experimental treatments, natural pollination, hand cross-pollination treatment, hand self-pollination treatment, autogamy, agamospermy. None of the experimented flowers produced fruits except natural pollination and cross-pollination treatment. The results confirmed that <i>E. angustifolia</i> is a self-incompatible, non-apomictic species that can not produce seeds through self-pollination. Introduced honeybee (<i>Apis mellifera</i>) was the main pollinator of <i>E. angustifolia</i> in the middle of Hexi Corridor region."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Flowers 1–3 in axils of older leaves. Pedicel short, ca. 2 mm. Flowers fragrant, outside silvery white, with dense white scales and sparse small yellowish glands, inside yellow. Calyx tube campanulate or broadly campanulate (f. <i>culta</i>), ca. as long as limb, 5–6 × 2.5–3(–5) mm; lobes lanceolate, ovate, or triangular- lanceolate, slightly shorter than tube, inside yellow and glabrous, with sparse small brownish glands, distinctly 3-veined, apex ± acute. Filaments short; anthers oblong. Style base enclosed by tubular disk, curved in upper part, ca. as long as calyx."
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Pollination: Fragrant yellow flowers are produced in spring and are insect pollinated [52,96]."

Qsn #	Question	Answer
	Pan, C., Zhao, H., Zhao, X., Liu, J., Liu, L., Hou, Y., & Zhang, L. (2011). Pollination ecology and breeding system of <i>Elaeagnus angustifolia</i> . Pp. 4507 - 4509 In Proceedings of the 2011 International Conference on Multimedia Technology. July 26-28, 2011, Hangzhou, China	"The results confirmed that <i>E. angustifolia</i> is a self-incompatible, non-apomictic species that can not produce seeds through self-pollination. Introduced honeybee (<i>Apis mellifera</i>) was the main pollinator of <i>E. angustifolia</i> in the middle of Hexi Corridor region."

606	Reproduction by vegetative fragmentation	n
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Asexual regeneration: It has been suggested that Russian-olive spreads by "underground rootstalks" [18]; however, there is no evidence in the literature that indicates that Russian-olive spreads by asexual reproduction under field conditions, except following injury or top-kill." ... "The occurrence of Russian-olive establishment from stem or root pieces in the field is unclear. "
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>E. angustifolia</i> is mainly established from seed, although cuttings are used in areas with sufficient moisture."

607	Minimum generative time (years)	3
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"According to Borell [16], the age at which Russian-olive produces its 1st seed crop varies with latitude, but seedlings typically produce fruit about 3 to 5 years after transplanting. Lesica and Miles [112] recorded the ages of fruit-bearing Russian-olive on the Marias and Yellowstone rivers in Montana. None of the Russian-olive trees sampled on the Marias River under age 5 produced fruit, while all trees over age 14 fruited. On the Yellowstone River only 1 of 38 plants ≤ 6 years old fruited in 1998. Fruiting generally began at 7 to 10 years of age, and 89% of Russian olive over 10 years old produced fruit. These results suggest the average age of 1st reproduction for Russian-olive on both rivers is around 10 years [112]."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Trees produce seed after 3-5 years, with birds and small mammals dispersing them in their droppings."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[No evidence. Fruits & achenes lack means of external attachment] "Fruits are drupe- or berry-like, oval-shaped, 0.4 to 0.8 inch (1-2 cm) long. A single, relatively large, 6-13 mm, oblong achene is enclosed in the fleshy fruit." ... "Most Russian-olive fruits remain on trees until distributed by animals, especially birds, mostly during the fall and winter. Seed may also be dispersed by water or ice."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	" <i>E. angustifolia</i> has been widely planted in shelterbelts, windbreaks or protective plantings as it is hardy, adaptable to a wide range of soil and moisture conditions and has a dense growth form (Brothers, 1988). It has also been used to revegetate land contaminated by paper mill wastewater (Wagner et al., 1994), potassium (Heinze and Liebmann, 1998) and bentonite (Uresk and Yamamoto, 1994), mine spoilings and as a bioindicator of heavy metal pollution (Aksoy and Sahin, 1999)."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[No evidence. Fruits & achenes relatively large & unlikely to inadvertently contaminate other produce] "Fruits are drupe- or berry-like, oval-shaped, 0.4 to 0.8 inch (1-2 cm) long. A single, relatively large, 6-13 mm, oblong achene is enclosed in the fleshy fruit." ... "Most Russian-olive fruits remain on trees until distributed by animals, especially birds, mostly during the fall and winter. Seed may also be dispersed by water or ice."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.). 2007. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Fleshy-fruited] "Drupe yellowish brown, globose-ovoid, globose, or subglobose (var. <i>casifica</i>), 0.7–2.5 × 0.5–1.3 cm, densely silvery scaly when young, subglabrous when mature; scales sparse, brownish; flesh sweet, mealy; stone oblong, oblong-ovoid, or narrowly cylindrical (f. <i>culta</i>), both ends obtuse or pointed."

705	Propagules water dispersed	y
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Most Russian-olive fruits remain on trees until distributed by animals, especially birds, mostly during the fall and winter. Seed may also be dispersed by water or ice." ... "Russian-olive seed may also be dispersed by fluvial transport [20,96,113,140]. Lesica and Miles [113] indicate that ripe fruits will float for up to 48 hours. Additionally, observations and evidence presented by Pearce and Smith [140] suggest seed dispersal by water and ice transport, although this was not tested directly and is not documented elsewhere in the literature."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Distribution may facilitate movement of seeds by water] "It is commonly found growing along floodplains, river banks, stream courses, marshes and irrigation ditches in the western states of the USA, and in desert or dry (150 mm annual rainfall) areas of Western Asia."

706	Propagules bird dispersed	y
	Source(s)	Notes

Qsn #	Question	Answer
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Seeds are dispersed by birds and small mammals."
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Several bird species consume Russian-olive fruit [16,47,138], and at least some are known to defecate viable seed [101]. For example, European starlings are effective dispersers of Russian olive in southeastern Oregon and may have contributed substantially to its spread there. Kindschy [101] observed large flocks of European starling foraging throughout the winter on Russian-olive fruit in irrigated grass meadows in southeastern Oregon. The starlings then roosted in larger trees such as black cottonwood and Siberian elm, dispersing Russian-olive seed below. When tested, there was no significant loss of viability (P<0.05) in seeds that passed through the digestive tract of starlings [101]. "
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Trees produce seed after 3-5 years, with birds and small mammals dispersing them in their droppings."

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[External dispersal may occur by seed-caching animals] "Fruit loosened by wind or feeding birds may also fall to the ground [16] where other vertebrates consume and cache Russian-olive fruit (personal observations cited by [96,113,138]), sometimes up to 500 feet (150 m) from the original sources (F. Johnson personal communication, as cited by [138])."

708	Propagules survive passage through the gut	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Trees produce seed after 3-5 years, with birds and small mammals dispersing them in their droppings."
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"When tested, there was no significant loss of viability (P<0.05) in seeds that passed through the digestive tract of starlings [101]. " ... "Lesica and Miles [113] observed raccoons eating Russian olive fruits and dispersing seed in their feces, although viability of these seeds was unknown. "
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Presumably Yes] "Seeds are dispersed by birds and small mammals."

Qsn #	Question	Answer
801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	[Unknown] "It is generally stated that Russian-olive produces a large amount of seed, but nothing quantitative was found in the literature." "

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The seeds can remain viable for up to 3 years and are capable of germinating over a broad range of soil types (Knopf and Olson, 1984). Germination is enhanced by stratification in moist sand for 90 days at 41°C (Vines, 1960)."

803	Well controlled by herbicides	y
	Source(s)	Notes
	Bovey, R. W. (1965). Control of Russian olive by aerial applications of herbicides. <i>Journal of Range Management Archives</i> 18(4): 194-195	"Control of Russian olive trees, rapidly encroaching on pasture land in the North Platte River valley, was studied by aerial application of herbicides. A 1:1 mixture of the PGBE esters of 2,4-D plus 2,4,5-T gave excellent control at 2 and 4 lb/A. Repeat application one or two years after initial treatment was necessary for the best results on large trees."
	Katz, G. L., & Shafroth, P. B. (2003). Biology, ecology and management of <i>Elaeagnus angustifolia</i> L. (Russian olive) in western North America. <i>Wetlands</i> , 23(4): 763-777	"Most published accounts of effective <i>E. angustifolia</i> suppression employ a chemical treatment, either alone or combined with mechanical techniques. Bovey (1965) reported successful control of <i>E. angustifolia</i> invasion by aerial spraying of herbicides (1:1 mixture of 2,4-D and 2,4,5-T, at 1.8–3.7 kg/ha), and Ohlenbusch and Ritty (1978) also reported effective control using foliar (2,4,5-T, Silvex (2,4,5-TP)), dicamba, and picloram in a 9:1 carrier solution of water and diesel oil) and basal (2,4,5-T, Silvex (2,4,5-TP)), dicamba, and tryclopyr ester in a 100% diesel oil carrier) herbicide applications. Edelen and Crowder (1997) reported significant initial damage to adult <i>E. angustifolia</i> when foliage was sprayed with a 4% solution of imazapyr (Contain, 14% active ingredient), although long-term response was not assessed. These approaches may not be feasible or desirable in many riparian settings (Ohlenbusch and Ritty 1978, Caplan 2002)."
	Weber, E. 2003. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	"Smaller trees may be removed with a weed wrench, larger plants should be cut at ground level. If stumps cannot be completely buried, they should be treated with a herbicide. Effective herbicides are 2,4-D or 2,4,5-T."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes

Qsn #	Question	Answer
	Zouhar, K. 2005. <i>Elaeagnus angustifolia</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ . [Accessed 5 Mar 2015]	"Several workers report that Russian-olive sprouts from the trunk, root crown, and/or roots after top kill or damage [34,49,52,59,112,140,148,172], and some report sprouting from roots and root crown following fire [35,201]. There is no information in the literature specifically addressing asexual regeneration in Russian-olive after fire."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The species resprouts from the root system."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Mechanical control, or burning alone, are ineffective] "Mowing seedlings, cutting, burning, spraying (Diesburg, 1994; Geyer and Long, 1994), girdling and bulldozing have all been attempted, although cutting, followed by either spraying or burning the stumps is the most effective (Olson and Knopf, 1986b)." ... "- Ability to sucker; fix nitrogen; regenerate rapidly"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Unknown. Not known to be present in the Hawaiian Islands

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Thrives in temperate climates (may only pose a threat to higher elevations in tropical island ecosystems)
- Widely naturalized in North America
- An agricultural and environmental weed
- Other *Elaeagnus* species have become invasive
- Often armed with coarse thorns
- Becomes less palatable with increasing age
- Pollen may be allergenic to susceptible individuals
- Shade-tolerant
- Tolerates many soil types
- Forms dense thickets
- N-Fixing
- Produces viable seeds
- Seeds dispersed by birds, mammals & water
- Seeds may remain viable in the soil for 3 years
- Able to coppice & resprout after cutting or damage

Low Risk Traits

- Palatable foliage when young
- Ornamental & medicinal purposes
- Self-incompatible
- Not reported to spread vegetatively (although able to sucker if damaged)
- Herbicides may provide effective control